Intertidal Fish Traps from Ireland: Some Recent Discoveries in Lough Swilly, Co. Donegal

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ORIGINAL PAPER

Intertidal Fish Traps from Ireland: Some Recent Discoveries in Lough Swilly, Co. Donegal

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Abstract Fish traps are one of the most widespread and enduring features of the maritime landscape. Recent research in Ireland has identified a great number of traps, most of which date from the early to late medieval periods. This paper presents the findings of a recent survey of Lough Swilly in north-western Ireland where a series of fish traps offers new insights into the survival, diversity and role of these sites in the post-medieval period.

Keywords Intertidal fish traps · Ireland · Maritime resources · Post-medieval

Introduction

Fish traps have been used for catching fish in a range of environments (fluvial, estuarine and maritime) from the Mesolithic to the modern era. These fixed traps present a barrier to the migration of fish, which are directed via arms (or leaders) to the apex (or eye) of the trap where they are collected. Those situated in a marine environment exploit the movement of fish to the shallows to feed on a rising tide and are most commonly designed to catch them on the ebb tide. They represent one of the earliest complex constructions made by humans that survive in the archaeological record. Their use as a means of catching large numbers of fish has made them central to economies, and has had a major role in the development of trade and enterprise among communities (e.g. O'Sullivan 2003). The range of shapes, adaptability and utility has made them a common feature in the maritime

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cultural landscape into the modern era. Fixed fishing traps or weirs have been reported globally—from the Americas, Australasia, Europe to Africa (see for example Bathgate 1949; Jones 1983; Godbold and Turner 1994; Dortch 1997; Nayling 1997; Barr 1998; Betts 1998; Bryam 1998; Moss and Erlandson 1998; Bannerman and Jones 1999; Erickson 2000; Turner 2002; Tveskov and Erlandson 2003). The number of European sites attracting archaeological attention has expanded in the past three decades, and work in Britain has highlighted finds across the British Isles—in Scotland (Bathgate 1949; Hale 2005), the Thames Estuary (Milne et al. 1997) and Severn Estuary (Godbold and Turner 1994; Nayling 1997; Turner 2002). Fish traps have also formed a key component of maritime landscape studies within Ireland, with notable concentrations having been identified in sea loughs and estuaries, although much of the research done to date has been focused on the medieval period. This paper reviews the evidence in an Irish context for marine fish traps that are predominantly medieval in date, and presents some new discoveries made in north-western Ulster of post-medieval fish traps with possible medieval antecedents.

Irish Fish Traps

The study of fish traps and weirs in Ireland has been underway from the 1940s, well ahead of mainstream archaeology which, at the time, perceived no archaeological significance or relevance in such structures. Initial interest was stimulated primarily by the work of Arthur J. Went. During his career as an officer with the Irish Fisheries Board, Went produced a series of articles on fish traps, detailing their structure, function and historical context (see Went 1945, 1946, 1948, 1963, 1969) (Fig. 1). Went's approach was primarily that of an historian with an interest in fishing techniques and paraphernalia; and he relied on documentary sources to determine the age and particulars of individual sites. Despite the huge volume of work that he produced, few academics of the day saw any importance in these monuments or their value to understanding the past (O'Sullivan 2001, 25). Went investigated a small group of post-medieval traps, for example at Waterford Harbour, Castle Bellingham, Co. Louth and at Doonbeg, Co. Clare, highlighting the wide variety among them (Went 1946; O'Sullivan 2001). The bulk of the historical records on fixed traps of any kind are found in the Parliamentary reports on the state of the nineteenth-century Irish fisheries. In 1964 Went published a seminal paper on salmon fishing in Ireland (Went 1964), which included a list of 40 stone salmon weirs that had been noted in the 1864 report of the Special Commissioner for Irish Fisheries. However, few have been investigated, while the dates of their erection and the duration of use have never been established. His work was to form the basis of one of Ireland's first major studies of intertidal fish traps on the Shannon by O'Sullivan (1993, 1994, 1995a, b, 2001).

Archaeological Studies of Fish Traps

In the past two decades a number of archaeological discoveries have prompted re-assessment of the long-term role played by fish traps in the maritime economy of Ireland. The two most extensive archaeological surveys that featured fish traps to date are the survey of the Shannon Estuary (O'Sullivan 2001; O'Sullivan and Dillon 2009; see Fig. 2) and Strangford Lough (McErlean and O'Sullivan 2002; O'Sullivan et al. 1997). Their importance has been underscored by the discovery of Mesolithic wooden fish traps,

Fig. 1 Location of Irish marine fish traps and weirs noted by Went (1946, 1948)

demonstrating their role in coastal economies almost from the start of human occupation here (McQuade and O'Donnell 2007). A number of other possible prehistoric fish trap sites have been identified, such as that at Newferry, Co. Antrim, where the remains of a basket from a possible fish trap were excavated (Woodman 1977).

During the 1990s a number of small-scale surveys by O'Sullivan in the Shannon region and its tributaries revealed a significant density of traps, particularly at the Fergus Estuary, Deel Estuary and at Bunratty (O'Sullivan 1993, 1994, 1995a, b; O'Sullivan et al. 1997). This work produced a wide range of wooden structures in the intertidal zone, comprising over 50 fish traps, the earliest of which (Fergus Estuary East no. 2) was dated to AD 440–645 (Table 1). Importantly, the project established the continuity of technique and design between the eleventh and fourteenth centuries, covering the Gaelic period and the later Anglo-Norman influences in the area (O'Sullivan 2001, 180–181).

A number of fish traps constructed between the fifth and seventh centuries belong to the pattern of exploitation of maritime resources by lords and ecclesiastical orders known

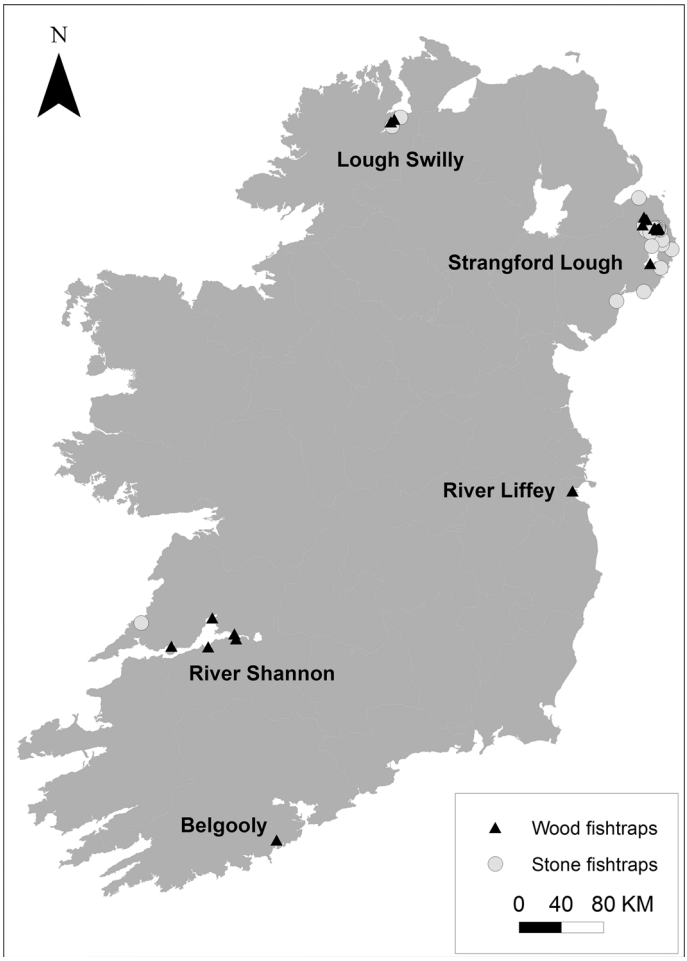

Fig. 2 Distribution of Irish intertidal fish traps investigated and/or dated archaeologically (Evans 1951, 1957; Woodman 1977; O'Sullivan 1993, 1994, 1995a, b, 1997, 2001; O'Sullivan et al. 1997; O'Sullivan and Dillon 2009; Breen 1999; McErlean and O'Sullivan 2002; McQuade and O'Donnell 2007; Wilson 2011)

throughout the British Isles (e.g. the contributions to Aston 1998; O'Sullivan 2001). By the twelfth to fourteenth centuries, political and social change as a result of the rise of Gaelic and later Anglo-Norman lordships in the area, led to traps becoming valuable economic resources that were claimed by ecclesiastical houses, as well as by bishops and secular lords (*ibid*. 180–181). Finally, the Shannon survey also described and dated post-medieval fish traps, such as Fergus Estuary east 5.2 (*ibid*. 193–232). O'Sullivan (*ibid*. 190–191), proposed a regional tradition based on the morphology of fish traps in the area, and underlined the strong continuity of regional design seen from the medieval to post-medieval periods.

The other major geographic area of research on intertidal fish traps was based in Strangford Lough, Co. Down, a large sea lough, almost entirely enclosed by the Ards peninsula, on the shores of which is found the largest grouping of stone fish traps in Ireland

Table 1 Irish radiocarbon dated fish traps (McErlean and O'Sullivan 2002; McQuade and O'Donnell 2007; O'Sullivan 2001, 2003)

Region	Site	Lab. no.	Date BP	Date
Dublin	Liffey fish trap	WK-16556	7144 ± 46	BC 6090–5890
Fergus Estuary, Shannon	Fergus estuary east 2	GrN-20139	1495 ± 35	AD 442–644
Greyabbey Bay, Strangford Lough	Chapel Island East	GrN-22592	1295 ± 20	AD 685–773
Greyabbey Bay,Strangford Lough	Chapel Island East	UB-3034	1213 ± 30	AD 711–889
Greyabbey Bay,Strangford Lough	Chapel Island West	GrN-22954	1145 ± 20	AD 783–979
Shannon Estuary	Bunratty 4	GrN-21933	960 ± 20	AD 1018–1159
Greyabbey Bay, Strangford Lough	South Island	GrN-21906	940 ± 20	AD 1023–1161
Strangford Lough	Bootown	GrN-21908	900 ± 20	AD 1037–1188
Deel Estuary, Shannon	Deel estuary 1	GrN-21932	900 ± 20	AD 1041–1208
Greyabbey Bay, Strangford Lough	The Ragheries	GrN-21905	880 ± 20	AD 1046–1218
Shannon Estuary	Bunratty 6	GrN-21934	820 ± 35	AD 1164–1279
Strangford Lough	Cunningburn	GrN-22955	785 ± 20	AD 1210–1278
Greyabbey Bay, Strangford Lough	Chapel Island West	GrN-22953	785 ± 20	AD 1220–1279
Greyabbey Bay, Strangford Lough	South Island	GrN-21907	760 ± 15	AD 1250–1273
Deel Estuary, Shannon	Deel estuary 2	GrN-20975	740 ± 15	AD 1262–1292
Deel Estuary, Shannon	Deel estuary 3	GrN-21931	640 ± 20	AD 1297–1392
Shannon Estuary	Clonderlaw Bay 3	GrN-20144	250 ± 30	AD 1522–1941
Shannon Estuary	Carrigdirty Rock 12	GrN-20977	220 ± 20	AD 1646–1943
Fergus Estuary, Shannon	Fergus estuary east 5.2	GrN-20141	155 ± 30	AD 1665–1946
Fergus Estuary, Shannon	Fergus estuary west 2	GrN-21927	160 ± 15	AD 1669–1942
Shannon Estuary	Clonderlaw Bay 1.4	GrN-20143	135 ± 30	AD 1675–1946

(13 confirmed and two possible). The Strangford traps fall into two distinct groups—wooden traps dating from the seventh to thirteenth centuries AD and stone traps of the twelfth–sixteenth centuries (McErlean and O'Sullivan 2002, 182–185). There are ten wooden traps, of which nine have been dated (see Table 1).

The stone traps represent a huge investment in terms of labour and were major economic projects of their day. They have been shown in Strangford Lough to post-date the wooden traps—excavation revealing wooden traps under wall foundations. They range in size from as small as 22 m long to 350 m, with an estimated original height of 1.0–1.5 m (*ibid.* 164–169), and the majority have been constructed using 'double boulder and fill', where paired stones were set on a bed of pebbles with the space between filled with smaller stones (*ibid.* 167–168). Morphologically, there is similarity between wooden V-shaped and tick-shaped traps; the later stone traps (the crescent-shaped traps are only known in stone) would tend to support their common origin.

Based on radiocarbon dating evidence and some historical documentation, the cluster of wooden traps in Strangford has been linked with the early medieval monastic estates of Movilla. The later stone traps in Greyabbey Bay have been connected to the Cistercian abbey of Grey Abbey, which was founded in AD 1193 (McErlean and O'Sullivan 2002, 77, 184–185). However in contrast with the Shannon Estuary, where there was no change in the type of traps used before or after the arrival of Anglo-Normans in the twelfth century, in Strangford traps change from wooden to stone during the change in political power following the invasion of AD 1177. The concentration and intensification of the stone trap

fisheries represents an investment by the Cistercian community underlining the status of the stone trap as a major economic resource. The export of fish to the home of the order (Holm Cultram on the Solway Firth, England) was part of a maritime trade corridor that linked Ireland and Britain that was utilised by Edward I to feed his army in Scotland in 1298 (*ibid*. 185).

In Strangford Lough there emerged a picture of medieval monuments that had a function not only locally, but also as part of wider economic and social patterns in the Irish Sea region. The involvement of the Cistercians and their organisation of the fisheries on a scale that superseded the requirements of the monastic table is an interesting aspect of the study, as it represents continuity of both local economic activities as well as exploitation of wider economic links. Apart from the Shannon and Strangford examples, a number of other traps have been noted by archaeologists. County Down has a number of stone traps outside Strangford—at Rossglass, Swinley Bay, Cloghy Bay, Temple Cooey near Ardglass and 'Lady Annesley's traps', located on the open beach at Newcastle (Evans 1951, 1957; Breen 1999).

The Shannon survey also resulted in the first modern archaeological investigation of wooden fish traps from the post-medieval period (O'Sullivan 2001, 193–232), dated to the period 1650–1940 (*ibid*. 225: Table 1). O'Sullivan investigated a range of later sites—creek, head and ebb traps, as well as number of stake traps spanning the seventeenth to nineteenth centuries. A number of possible post-medieval wooden fish traps have also been reported, e.g. Belgooly, Co. Cork (Wilson 2011).

The vast majority of tidal fish traps investigated in Ireland come from enclosed marine or estuarine zones (see Fig. 2), and are sited on estuarine channels and river mouths that attract feeding and breeding fish due to the nutrient-rich environment supplied by rivers (McErlean and O'Sullivan 2002, 157). A number of exceptional marine traps such as 'Lady Annesley's fish traps', at Newcastle Co. Down (Evans 1957) have been discovered on the open coast, set on beaches that are more exposed to wave and wind. It should be acknowledged too that the sheltered contexts with their superior levels of preservation are likely to introduce a degree of bias to the archaeological record.

The chronological profile of Irish fish traps is heavily dependent on the dating of wooden sites, with the ages of stone traps being determined by their relationship to wooden structures revealed through excavation, or by the use of supplementary historical evidence. The dated traps are predominantly medieval, with notable clusters in the eleventh to thirteenth centuries (see Tables 1, 2). However, there is no universally agreed chronology for the progression from wood to stone or vice versa, so that the wood-based chronology presents only a partial picture.

Went's study of fish weirs was focused on the major rivers in Ireland that were known, or had been known in recent history, to accommodate fish traps. In many cases only his accounts survive, as traps were cleared away in the mid-nineteenth century to facilitate navigation (Went 1946, 176). Some may have been completely removed, while others were simply punctured to allow shipping to pass, and significant remains may survive. Went's survey also gives us possible locations in the Shannon for further research as noted by O'Sullivan (2005, 65–77), where there is close geographic continuity between medieval and post-medieval traps. In addition stone fish traps such as the Rossglass, Co. Down example show that despite being made of durable materials, fish traps were susceptible to being 'robbed out' for building material (Breen 1999). As well as being disturbed another factor affecting preservation is erosion by natural currents, such as the Borland Rock wooden trap in the Shannon estuary Co, Clare (O'Sullivan and Dillon 2009).

Table 2 C-14 dates for fish traps on Lough Swilly

Townland	Sample ref.	Nature of sample	Species identified	Cal. C14 date at 2-σ
Killydonnell	SL0047A	Upright with bark	Birch (*Betula* sp.)	1693–1727 [UBA-20978] 1812–1919 1952–1954
Killydonnell	SL0047B	Upright narrow	Oak (*Quercus* sp.)	1682–1736 [UBA-20979] 1804–1898 1901–1935 1951–1953
Ardrumman	SL0048A	Upright	Pine (*Pinus* sp.)	1681–1738 [UBA-20980] 1756–1761 1803–1896 1902–1937 1951–1953
Ardrumman	SL0048B	Wattle	Gorse (*Ulex* sp.)	1683–1735 [UBA-20981] 1805–1897 1902–1932 1951–1953

Physical and Cultural Context

Lough Swilly is located within Co. Donegal, the northernmost county in Ireland, where a series of sea loughs have been formed between peninsulas jutting into the Atlantic, and the largest of these, Inishowen, forms the eastern shore of Lough Swilly, Fanad the western (Fig. 3). It was heavily shaped by the last Ice Age, when glaciation created a linear trough

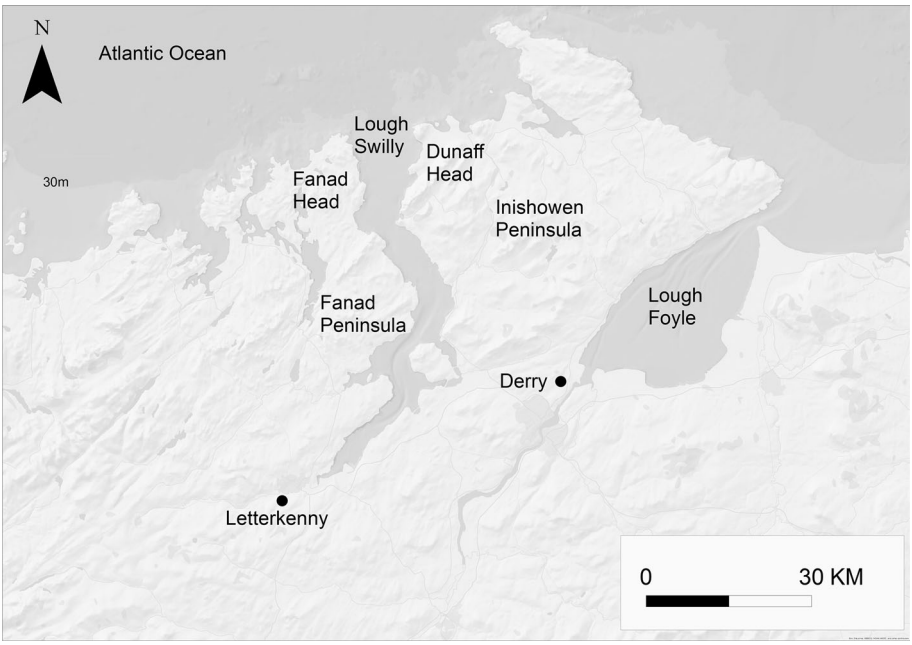

Fig. 3 The physical topography of Lough Swilly and local geographical features

or fjord 130 m deep and orientated north–south (Glasser and Ghiglione 2009; Evans 1973). The Lough has a surface area of some 150 km^2 with an undulating and deeply indented shoreline punctured by a number of nutrient-rich rivers and streams (e.g. the Swilly and Lennon Rivers). The bathymetry decreases gradually from 30 m at the mouth of the Lough, towards the mouth of the River Swilly, where extensive intertidal flats are exposed at low water. The tidal range averages 3.5 m on spring tides and 1.4 m on neap tides. The present sea bed is characterised by gravelly sand at the mouth (between Dunaff Head and Fanad Head), clean sand between the mouth and just to the north of Buncrana, and muddy sand further upstream to Letterkenny at the head water of the Swilly River (British Geological Survey 1986). The outer Lough is 6.7 km wide at its mouth between Fanad Head and Dunaff and comprises high, rocky cliffs, rocky offshore islands, sand dunes, salt marshes and sandy beaches. The inner Lough is a blend of low headlands, intertidal sand and mudflats, with mudflats being the dominant habitat. The upper shore line of most of the Lough is characterised by a mix of exposed seams of bedrock and glacial deposits that form thin boulder fields around the high water mark. The morphology of wide intertidal zones with a large tidal range and high input of nutrient rich water offers a perfect setting for intertidal fish traps.

The Lough Swilly area has been inhabited from early prehistory, with a number of Mesolithic and Neolithic sites recorded along the coastline (Milner and Woodman 2001). The area of Co. Donegal is roughly equivalent to the Medieval Gaelic lordship of Tír Chonaill, after it expanded to incorporate the Inishowen peninsula by 1247. The ruling dynasty, the O'Donnells, was linked to minor septs and Scottish mercenary groups (Quinn 1993, 621). Around the Lough, tower houses and fortified sites dot the landscape—remnants of O'Donnell strongholds, as well as number of late-medieval monastic foundations endowed by them (Lacy 1983).

The end of the sixteenth century saw the turmoil of the 9 Years War and brought about the collapse of the Gaelic order. This created the opportunity for the Plantation of Ulster, a large-scale colonisation project designed to consolidate British control over the most troublesome part of Ireland. The settlers who started to occupy the newly created Baronies of Donegal (Inishowen, Kilmacrenan, Boylagh, Lifford, Portlough and Tirhugh) were a mix of English and Scottish undertakers, along with some Irish (Annalecta Hibernia 1931, 167). The lands around the shoreline of the Lough were divided between major land holders such as Lord Chichester who received a large area of Inishowen (Hill 1877, 177). Smaller grants were made to military personnel such as Captain William Stewart, who received the land around Rathmelton that formed the core of the Stewart estates in Donegal (1000 acres), as well as free fishing in Lough Swilly (Hill 1877, 323). As well as its own port towns, the Swilly area is close to the major port of the north-west, Londonderry. Lough Swilly played a role in the economic boom of the seventeenth and eighteenth centuries in Ulster, as a rural zone that produced a range of foodstuffs and raw materials such as flax for the linen industry.

Recent Discoveries in Lough Swilly: *Background to Discovery*

The systematic survey of Lough Swilly shore and intertidal zone between 2011 and 2013 identified a total of five intertidal fish traps (Fig. 4). Of these, three are stone traps (one confirmed and two possible) and two wooden fish traps. Their state of preservation is generally good, although the structures of some parts appear to have been damaged by

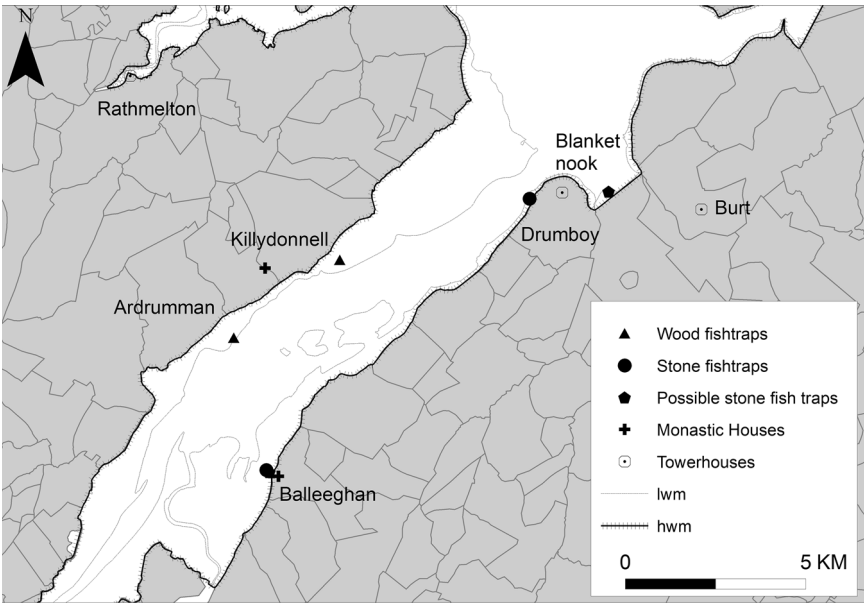

Fig. 4 Fish traps identified through the Lough Swilly intertidal survey

human activity in the Lough, principally dredging for shellfish. Interviews with the local fisherman and shellfish producers suggest that at some time in the past there were as many as seven wooden traps located on the foreshore on the western side of the inner Lough. However none of those interviewed suggested that the traps had been actively used in past 100 years.

Interviews conducted with groups of local shellfish gatherers who have worked the shore for generations produced some of the local folklore of Lough Swilly, including stories of the 'monk's traps' in the area of the medieval Franciscan Friary at Killydonnell (per.com interview J.H 2011). Reports of wooden remains on the foreshore in front of the Friary were made to the Underwater Archaeology Unit of the Irish government, who commissioned a brief survey of a number of locations (Anonymous 2011). These preliminary visits led to the positive identification of two sites, both of which were highlighted as being in possible danger from human activity in the Lough. Subsequently, a wider survey of the intertidal archaeology of the Lough was undertaken by the present authors, and the sites were surveyed and sampled along with stone fish trap sites not previously documented in the area.

Wooden Fish Traps

The sites of two wooden fish traps were identified on the wide intertidal mud and sand flats on the western side of inner Lough Swilly. The hinterland here has a number of sites likely to be related to the fish traps, including the early seventeenth-century bawn and estate at Fortstewart. Radiocarbon dating for two of the traps (Table 2) has placed them all in the post-medieval period and suggests that the traps contributed to the economies of the seventeenth and eighteenth century in Lough Swilly.

Killydonnell Fish Trap

Located in the townland of Killydonnell, one of the arms, or leaders, of a fish trap in the form of a line of post stumps survives in the intertidal zone (Figs. 5, 6). The upper shoreline is dominated by an area of large boulders and stones, giving way to an intertidal zone some 180–200 m wide, and comprising a mix of soft mud and recently deposited silt from the river. Due to the tidal conditions the entire structure is rarely exposed, and the stumps in the subtidal zone become obscured by soft mud, making detection only possible by touch. The most seaward post detected during survey was located less than 10 m from the edge of the dredged navigation channel in the lough. The single line of the stumps of upright posts runs north-west/south-east through the lower portion of the intertidal zone and into the subtidal zone. It is some 63 m long, with an average of 15–20 stumps per metre, making at least 1000 survivals in total. Those posts that are exposed protrude only a centimetre or two above the sediment, and their tops are quite flat giving the appearance of having been eroded in situ (Fig. 5).

The original posts were shaped from young saplings with fully formed knots, and their bark remains. Two wood species were used, with clusters of oak (*Quercus* sp.) present amongst the birch posts that formed the majority (*Betula* sp.: O'Donnell 2012). Survey indicated 36 % of stumps were oak and 63 % birch, the average stump width for oak being 4.05, and 7.36 cm for birch (Fig. 7). The birch is present along the entire surviving line of the leader, with the clusters of oak more common toward the seaward end. These may be repairs or replacements for damaged posts (radiocarbon dating was not accurate enough to provide a relative chronology, see below). The posts are set very close together, almost touching in some cases, forming a barrier of uprights to prevent fish from passing. The area in which the trap is located has a water depth of 60–90 cm at mean high water, meaning that the upright posts originally needed to be of a similar minimum height to be effective. Investigation of the lower portion of the trap was hampered by sediment accretion and dredging of the navigation channel, which most likely destroyed that part of it. However, it

Fig. 5 Line of post stumps of the Killydonnell trap running south-east across the intertidal zone (P. Montgomery)

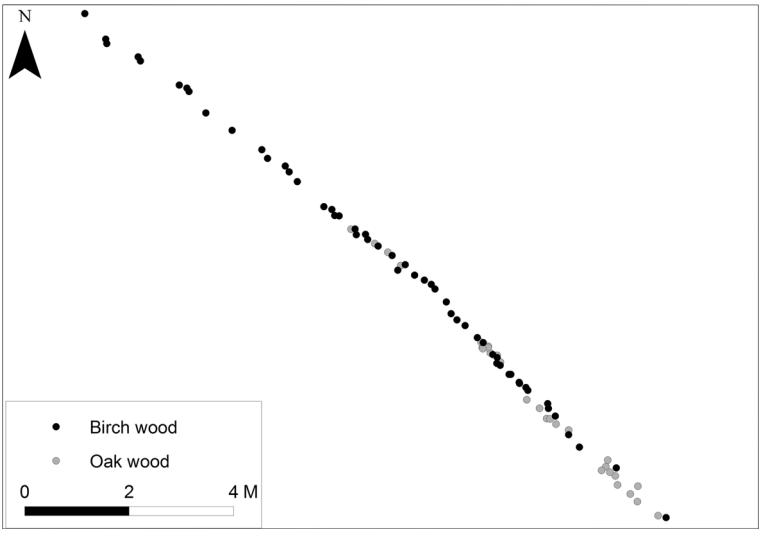

Fig. 6 Plan of the Killydonnell fish trap posts of the leader indicating a mix of wood species: predominately Birch (*Betula* sp.) posts at the shoreward end with small clusters of oak at the seaward end. *Note* HWM is 200 m to the northwest; LWM is 10 m to the south

Fig. 7 Detail of the Killydonnell posts, a layer of *dark brown* or *red* bark visible on the thicker birch stump (*Betula* sp.) next to the smaller oak (*Quercus* sp.) post (P. Montgomery) (Color figure online)

is likely to have taken the form of a basket as seen in similar structures elsewhere, including the Shannon traps (O'Sullivan 2001). The surviving part of the trap is one of the leaders of what was a V or tick-shaped weir. Despite much of trap being obscured or lost, it can be suggested that it functioned as an ebb trap, based on the orientation of the leader and ebbing tide across the foreshore.

Ardrumman Fish Trap

A second wooden fish trap is situated in Ardrumman townland, approximately 3.5 km to the south-west of the site at Killydonnell (Figs. 8, 9). It is located in the lower area of the

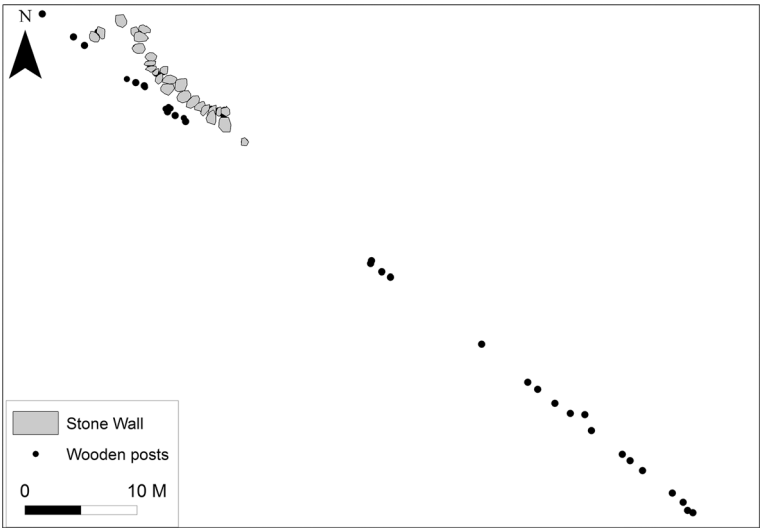

Fig. 8 Map of the Ardrumman composite fish trap located on lower portion of intertidal zone. *Note* HWM is 400 m to the northwest; LWM is 7 m to the south

Fig. 9 View of Ardrumman fish trap looking south-eastwards. The trap is located in an area of soft transient mud that sits below the mean low-water mark, and becomes clearly visible during spring tides (P. Montgomery)

intertidal zone some 400 m from HWM, at the mean low-water mark and is only accessible for small periods during spring tides. This area of the intertidal zone is dominated by deep, soft mud and shell banks, overlying a compact detritus of shell-rich sediment, into which the stakes have been set.

The partial remains of the structure, a fence 42 m long, comprises a line of eroded upright posts set at least 1 m apart which formed part of fence. At the shoreward end are the remains of a dry stone wall 9.3 m long and ranging in width from 40 to 1.0 m wide. A single layer of rough boulders was laid haphazardly as a low wall running along the base of

part of the trap, forming a support for posts. Composite fish traps of stone and wood are not common in Ireland, although they have been recorded in Scotland (Hale 2005). Those posts that are visible are set on south-western side of the walling and extend south-eastwards, where a finger-tip survey into the mud was required to locate a further 30 posts extending into the subtidal zone. Due to damage, only a small number of posts had intact tops, those sampled ranged in width from 3 to 11 cm (average width of 6.7 cm). Observations of the wood revealed heavily knotted posts that had been stripped of their bark and were irregularly shaped, suggesting that they were worked branches or saplings with prominent knots. The remnants of part of the panel of the fence were exposed at one post, where a withy 30 cm long was bent around the base of the stump. Its shape and appearance indicated that it was stripped of its bark, and twisted into place. The uprights were found to be of Scots pine (*Pinus* sp., O'Donnell 2012, 2). Sampling of the withy identified it as being made of gorse (*Ulex* sp.) (Fig. 10), a native shrub not previously identified in fish traps (O'Donnell 2012, 2). The choice of both species has chronological and likely environmental implications for the sites (see below).

Morphologically, the Ardrumman trap is similar to the Dingwall ebb trap on Cromarty Firth in Scotland. A diverse mix of composite traps known collectively as 'yairs' are found in the area, and the Dingwall yair comprises a series of traps at the same location, that are composed of wooden posts revetted with stone (Hale 2005, 120–123). These V-shaped traps have been radiocarbon dated broadly to the seventeenth to nineteenth centuries (*ibid.* 122). The Ardrumman trap lacks an obvious eye or basket and this is also known from post-medieval yairs, some of which were operated with removable cord nets set on the wooden post (Hale 2005, 120–122).

As part of this survey, two other sites, in Killydonnell and Ardrumman/Cashelhanghan townlands, were highlighted as potential sites of wooden fish traps, based on interviews with local shellfish gatherers who have spent decades working the shoreline of the Lough. The first located in the Killydonnell townland, some 190 m to the south of the nineteenth-century Fortstewart pier. It was described as a row of posts on sand 300 m below the HWM and 600 m from LWM, but the area has large amount of sand accretion obscuring any possible remains. The second was believed to have been on a sandbank jutting out into Lough at the boundary between Ardrumman and Cashelhanghan townlands, some 1300 m from HWM. It usually appeared for a short period at low water as a grouping of upright

Fig. 10 Exposed remains of the gorse withy bent around a post (P. Montgomery)

wooden posts that may have been accessed in the past by boat. Due to human activity and structures (piers, quays), and changes in the sedimentation process, and the impact of commercial shell fishing in the Lough, these sites are no longer visible though they may remain buried.

Stone Fish Traps

Three stone fish traps have been discovered on the wide intertidal mud and sand flats on the western side of inner Lough Swilly. Two of the traps were located and investigated in detail, the third, at Blanket nook is in an area of soft sediment that has accumulated due to nineteenth century reclamation works.

Drumboy fish trap is located on the eastern side of the inner Lough. The townland is located at the tip of a former peninsula which, in the past, must have been of some strategic importance in the medieval era as a border between the lands of the O'Donnells and O'Dohertys, and featuring a sixteenth-century tower house to the north-east of the trap (*Cal. State Papers Ireland* 1601, 278). Drumboy tower house was held by the O'Donnells, it was first mentioned in historical tradition as being built in the late fifteenth century and still inhabited despite being broken down in 1601, cartographic evidence shows it still standing in 1690 and demolished possibly as late as 1840s (*Cal SPI* 1601: 278; Davies and Swan 1939, 201). The close physical relationship between the fortification, the coastline and their fisheries has a precedent within the context of Gaelic fortifications (Ní Loingsigh 1994, 148; Breen 2005, 109–121). The area was granted in 1608 to John Cunningham, a Scot, who established a bawn and small village there (Hill 1877, 505). Part of his entitlement was the liberty to fish for free in the Lough, and it may be that the later alterations occurred then to allow re-use of a medieval fish trap that was already established.

The trap is V-shaped; comprising two arms at an angle of approximately 40° pointing downstream, in other words, an ebb trap. The shoreward arm runs north-westwards down the face of the beach from the upper shore towards the point of the eye, and is 43.0 m long and 70 cm–1.0 m wide. It comprises a wall standing two or three courses, on average 30 cm in height. The construction has similarities with the double-boulder-and-fill structures observed in the Strangford Lough stone traps (McErlean and O'Sullivan 2002, 167–168; see Figs. 11, 12). The boulders used in the wall are derived from local fields, where glacially deposited rolled boulders are found. The inner wall seems to have been affected by wave and current action, as its base is exposed.

The seaward arm of the trap is much longer than its shoreward counterpart (Figs. 11, 13, 14), and is 80 m in length to the mean low-water mark, with a subtidal extension for a further 40 m. Better preserved than the inner arm, it is roughly 1–2 m wide and two or three courses high at the point where it reaches the eye. Closer to the low-water mark there is a mound of debris reaching 5 m wide at some points that represents collapse from the wall. Examination of the wall shows the same double-boulder-and-fill as the inner arm. The eye of the trap functioned as a walled barrier to impede the movement of fish and allow collection as water drained through it on the ebb tide. This form of barrier has also been noted at Newcastle beach in Co. Down (Evans 1957, 227–228).

The wall of the trap has been roughly pierced close to the most northerly point and now features a 1.3 m gap between the two arms, which opens into a rectangular enclosure some 6 by 7 m, formed by a single line of boulders (Fig. 11). The simple build of the enclosure is in contrast to the double-boulder-and-fill arms of the trap and cannot be considered as part of the original construction. It forms an area where fish would have been collected. In

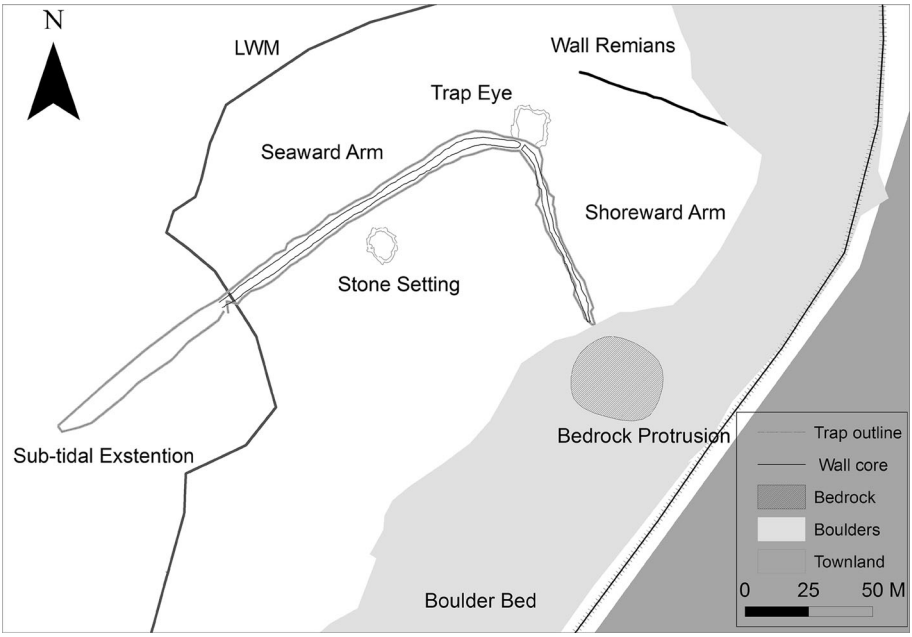

Fig. 11 Map of the Drumboy trap, which is located on a foreshore characterised by a boulder field toward the beach and a mix of sand and mud on the lower shore. The shoreward arm of the trap utilises an area of exposed bedrock and boulders that forms part of the physical barrier. The use of natural barriers in stone traps has also been observed in sites both in Wales and France (Bannerman and Jones 1999; Langouet and Daire 2009)

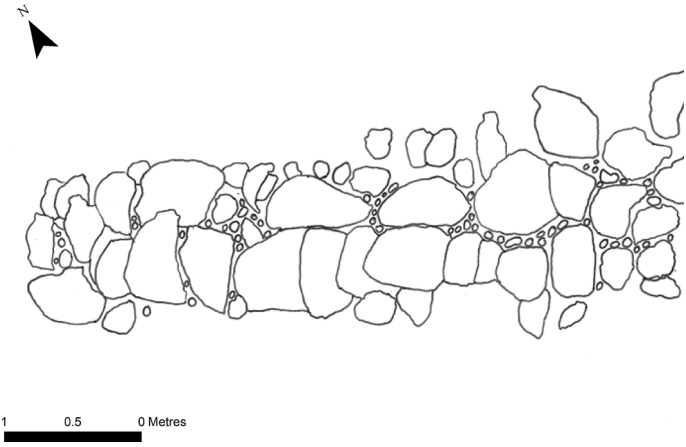

Fig. 12 Plan of a portion of the shoreward leader at Drumboy. The double wall is comprised of a mix of flat slabs of local schist and small glacially rolled boulders

addition the rectangular enclosure is not positioned centrally outside the apex of the trap, rather slightly to the eastern side. The structural dissimilarity between this structure and the arms of the trap, coupled with its offset position suggest it is a late alteration.

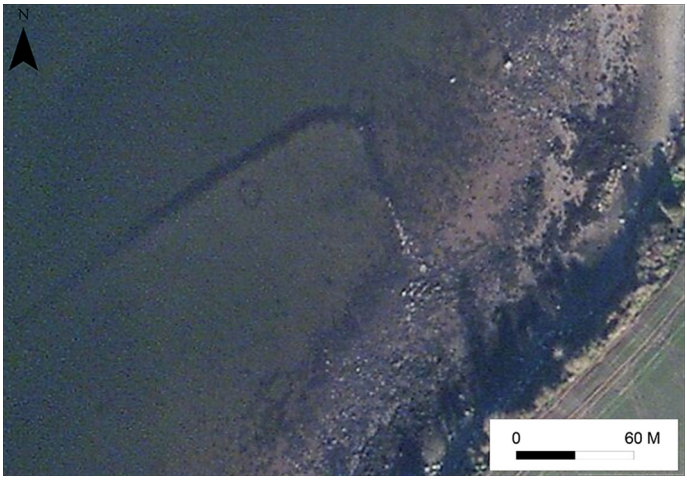

Fig. 13 Aerial photo of Drumboy trap (Bing Maps Aerial 2010, © 2010 Microsoft Corporation)

Fig. 14 View of the leader of the Drumboy trap from the west-south-western, seaward side of the trap (P. Montgomery)

To the rear of the V-shaped arms, a small, circular feature formed of a single line of stones, of maximum diameter 8.3 m, was noted also. Structurally it is similar to the rectangular walling noted beyond the eye, and both must be late additions. Its function is hard to define, but the location further down the shore suggest that it might be a holding pen of some sort for fish, as it remains filled with water until the end of the tide. To the north-east of the trap, a wall comprising a single line of stones, 53 m long, runs across the intertidal zone (Fig. 11). It is oriented from the shore towards the outer arm of the trap, and may represent an aborted attempt to form a much larger trap. Nevertheless, the morphology of the wall has more in common with the roughly built, late features noted above.

The trap is located midway out in the channel of the lough, remote from any fresh water course which would attract diadromous species such as salmon (*Salmo salar*), sea trout (*Salmo trutta*) or eels (*Anguilla Anguilla*). Documented species inhabiting the shallows here include demersal fish such as plaice (*Pleuronectes platessa*), flounder (*Platichthys*

flesus) as well as codling (*Gadus morhua)*. Migratory shoals of pelagic species—winter herring (*Clupea harengus)* and summer mackerel (*Scomber scombrus*: see Went 1966, 1971)—are known in season. Similar stone traps located to take a range of inshore shallow water species have been documented in Greyabbey Bay, Strangford Lough (McErlean and O'Sullivan 2002, 181).

Stone Fish Trap at Balleeghan

The partial and obscured remains of a trap is located in the intertidal zone at Balleeghan townland, some 175 m from the HWM, and adjoining the site of a medieval Franciscan Friary (*Cal. SPI* 1600–1601, 278; Lacy 1983, 328–329). The land was given to a member of the Scottish Cunningham family, by James I in 1608 (Hill 1877, 295, 506). The intertidal zone in the area is characterised by mud and stone giving way to boulders on the upper shore (Fig. 15). Running north-west/south-east, a large linear feature was noted during aerial photographic surveys of the area. Survey indicated a stone structure lay underneath a covering of shells. The shell bank largely conceals all structural details, although some stone is visible in places. The extent of the structure is therefore hard to define; however, probing indicated it was at least 73 m long and 4–6 m wide. Although the width is greater than that seen at the core of most stone fish traps, the extent of collapse around the original core was obscured. The shell bank was over 80 m long and averaged 7–8 m wide (Fig. 16), and the wall was 20–30 cm below the surface, while the surrounding mud was over 2 m deep in places. The angle and shape of the remains indicate that this is one arm of a fish trap, the other not having been detected, although there are scatters of stone around the seaward end that may indicate where more of the structure might lie buried.

A further possible fish trap, not yet definitively identified due to difficulty of access, and also heavily obscured by shell and deep mud is located at the mouth of the former

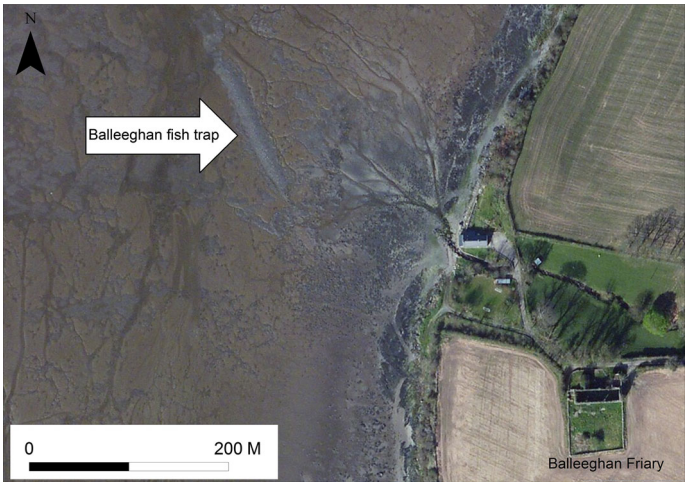

Fig. 15 The Balleeghan trap. Its shape and the angle to the falling tide underline the man-made origin of the bank. To the west of the wall is a depression representing a former intertidal drainage channel, and to the east a fresh water stream. The location close to a fresh water channel, is similar to that found in many of the fish traps of Strangford Lough (Bing Maps Aerial 2010, © 2010 Microsoft Corporation and its data suppliers)

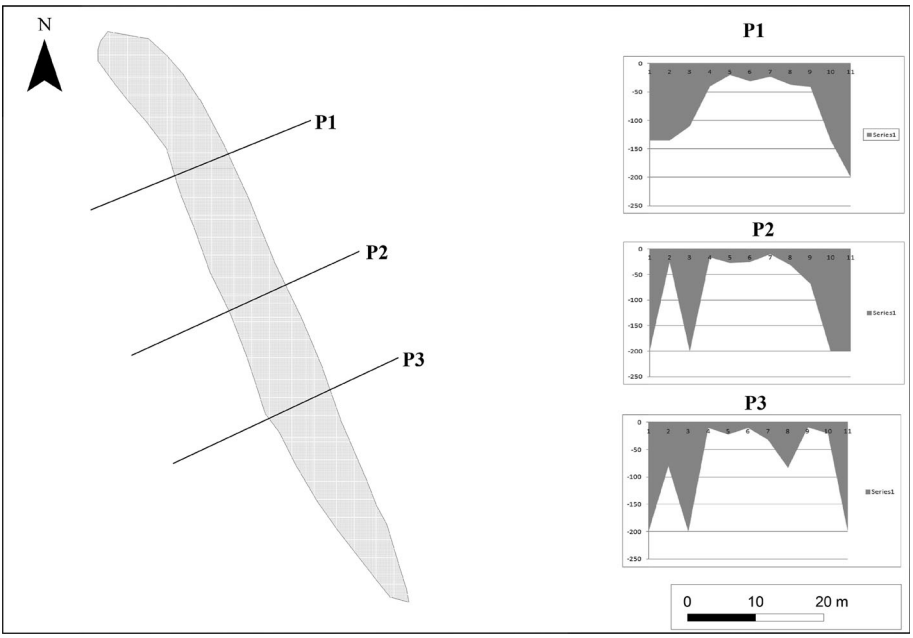

Fig. 16 Plan and profiles of the Balleeghan shell bank obtained by probing. *Note* sediment shaded in section

embayment of Blanket nook. It again takes the form of a linear bank of shell running for some 1000 m, and meandering across the bay in a manner reminiscent of Doonbeg in Co. Clare (Went 1946; O'Sullivan 2001). The site would have lain across the entrance to a much larger intertidal area, with a freshwater stream to the east. However it was reclaimed in the mid-nineteenth century, restricting the flushing action of the ebb tide and stream, thus contributing to substantial sediment accretion.

Discussion

The fish traps of inner Lough Swilly are situated within a landscape that has a strong Medieval ecclesiastical presence, namely the twin Franciscan houses of Killydonnell and Balleeghan, both founded around 1471, and having their lands and properties confiscated after 1603 (Gwynn and Hadcock 1970; Lacy 1983). In addition there are documented or extant medieval tower houses at Drumboy and Inch. Ethnographic reports of fish trap sites known as the 'monks' traps' on the northern shore, and the reported presence of a further five sites on this shore hold out the prospect for the future additions to the corpus (J.H 2011 personal communication). Results from the radiocarbon dating returned an almost contemporary series of date ranges for the Killydonnell and Ardrumman traps, indicating a post-medieval establishment from the late-seventeenth to the early twentieth centuries. Unfortunately the technique offers poor resolution for dating in recent centuries (due to the Suess effect: 1955) and other traps dated to this era have experienced this effect. In these circumstances it may be possible to eliminate certain intercepts (age ranges) on the basis of

documentary indicators, associated stratigraphy, finds or other circumstantial evidence (Hoper 2012 personal communication).

The wooden traps show two distinctive structural forms—the post-and-wattle fence at Ardrumman and the closely set uprights of the Killydonnell trap, two distinctive trap types being in use in the roughly same time period in the same context. This might suggest a persistent use of an earlier tradition in conjunction with an introduced type. The Killydonnell fish trap is composed of a mix of oak and birch, both common native species that have been employed in fish traps from early medieval times (e.g. O'Sullivan 2001, 183). The wood used in Ardrumman fish trap represents a mix of species that are rare in fish traps in Ireland—pine posts and gorse wattling. Pine was a common Irish species until it disappeared in the early medieval period and was absent from Ireland until its reintroduction in mid-seventeenth century (McCracken 1971, 17)—an historical reappearance that corresponds well with the post-medieval radiocarbon date but does not provide a terminus date. Despite being a native species, gorse has not been documented in Irish fish traps to date. The use of gorse appears to have become more common as it thrived on a wide range of soils in a period when wood species traditionally viewed as preferable for fish traps were becoming scarce (Feehan 2003, 205–209). Its employment for fish trap construction may be due to its richly resinous nature, it was also used as infill in drainage ditches protecting wood pipes from decay in acidic soils (Lucas 1958, 43–44). This resistance would have been equally advantageous in the marine environment, and its appearance may be a response to the increasing scarcity of timber in the post-medieval era.

Structurally, the stone fish trap at Drumboy has parallels with the others in Ulster, such as those used in Strangford Lough until the end of the sixteenth century. The Drumboy trap was positioned to enclose an area of foreshore, taking advantage of the long-shore current running down the eastern shore of the Lough. The Balleeghan site is located on a tidal mudflat at the mouth of a freshwater stream. Both locations find parallels with the Strangford stone traps (McErlean and O'Sullivan, 2002, 174–175).

Fisheries were an important resource in medieval and post-medieval Ireland, and while other aspects of the economy such as farming and land management were subject to change under the new Plantation schemes, the use of established trap sites may have persisted. The lands and holdings of the Catholic Church ceded to new British landholders after 1603 included the fisheries of Lough Swilly (Moody 1938, 207–211). The early seventeenth-century survey of escheated counties noted five fisheries within Lough Swilly, which were included in land grants (*ibid.* 92-292; McNeill 1931, 151–218). Captain William Stewart received a large grant of lands around the mouth of Lennon River with the rights to its fisheries between 1610 and 1613, which formed the core of the Stewart family's estate until the 1960s (Hill 1877: 323; Went 1966, 124, 128). Whether these early fisheries included fish trap sites is not made explicit.

The earliest reference to intertidal fisheries appears in the accounts of the Stewart estate in 1727, which mention the rent of a group of small islands at the mouth of the Lennon River known as the Craig Islands (PRONI D2358/4/1). A fishery (of which nothing remains) and an area of eight acres was valued at five pounds per annum—equal to the value of 121 acres of farmland over the same period. The most important eighteenth century reference to intertidal fish traps is made by the Reverend William Henry in 1739, who noted (Henry 1739, 338) two methods of fishing used in the lough:

> The whole of the lake abounds with fish of all kinds, It would seem incredible to behold the infinite numbers of flounders taken upon some of the flat sands by laying a net across a gullet in the strand on the ebbing of the tide. In other places fish of all

> kinds are taken as in a pound. Upon some point jutting out into the lake by which fish are wont to laye, a square inclosure made of stone without mortar is built, as far as is convent within the sea mark. The sea flowing over this pound brings into it all kinds of fish which continue there still upon the ebb of the tide, its sinks away from them, through the crevices of the stones and leave them set up on the dry strand.

His description clearly indicates that stone fish traps were still being used in early eighteenth century, although wooden traps had been superseded by draft nets across intertidal channels.

By the nineteenth century there are references to a host of shore-based fishing methods, although nets had replaced the older methods of capture (Went 1956, 1966). Surprisingly there are no references to the continued use of intertidal fish traps in the otherwise detailed Irish Fishery Reports of 1837 and 1846, which would imply they had gone out of use by this time. One early nineteenth century reference might hint at some of the circumstances leading to the abandonment of the traps. In 1832 a protest was noted in *The Times of London* (10 May, 1832), referring to an 'uprising' of local tenants at the home of landlord James Stewart. His Salmon Fishery Company, which was worth £200 pounds per annum, was engaged in stake net fishing along the shores of the Lough. The protest was a reaction to the impact on the fishing activities of his tenants, making them unproductive due to the drop in the number of fish reaching the inner Lough. Study of stake net fisheries on the Shannon also suggested that the success of traps in the lower Shannon in the nineteenth century led to the abandonment of traps upstream in the inner estuary (O'Sullivan 2001, 226). This constitutes one possible reason for demise of the Lough Swilly traps and the lack of evidence about them.

Conclusion

The discovery and identification of a group of stone and wooden fish traps provide some insights on the cultural evolution of Lough Swilly. Although accurate dating has been challenging, there is clear evidence on morphological, circumstantial and documentary grounds for placing both wooden and stone fish traps in the post-medieval era—spefically the late seventeenth to mid-eighteenth century. The stone examples may be evidence for the continued use of established sites of some age; however the wooden examples represent the final structures of their type for catching fish in the shallows of the Lough. Other wooden traps may survive—as tradition suggests—but these have yet to be detected. The contemporary employment of stone and wooden traps in the post-medieval era stands in contrast to both the Shannon (which had a tradition of wooden traps) and Strangford Lough (where wood was replaced by stone). In addition, the differing structure of the two wooden traps from the same period is suggestive of a number of building traditions and possibly differing evolutionary trajectories for these trap types.

The seventeenth century saw significant changes in the political and social culture of Ireland, and the shores of the Swilly were transformed from a Gaelic-dominated landscape to one shaped by settlers predominantly from south-western Scotland, with the Stewart and Cunningham families, from Ayrshire and Galloway respectively, particularly significant. The small communities of their countrymen that followed stood in contrast to the natives in the landscape to the extent of physical separation; as seen from the placenames Scots *Aughnish* and Irish *Aughnish* (PRONI D2358/5/1). The Scots arriving in Ulster were familiar with fish traps as a component of their maritime economy—with examples in

stone on exposed coasts predominant in Ayrshire and Galloway. Their arrival on the shores of Lough Swilly may have resulted in the introduction of other traditions of trap making, witnessed in the similarities between the Ardrumman and Dingwall traps, albeit the latter example is from north-eastern Scotland. This continuity of tradition contradicts the general view of the Plantation in Ulster resulting in the older modes of the economy and lifestyle (e.g. agriculture, architecture) being eclipsed by new practises. Historically the estates that were granted in the seventeenth century have been viewed as primarily agricultural resources; however the Swilly demonstrates that the exploitation of maritime resources was a significant aspect of the economy. Fisheries were recognised as a valuable economic resource from the outset of the Plantation and continued to be at the core of economic life, being sources of social conflict between landlords and tenants as late as the 1840s.

The growing number of fish traps discovered and investigated on regional basis would benefit from a broader and more systematic analysis. For example, the diachronic study of the morphology, environment and function of Breton fish traps resulted in a reappraisal of their chronology and evolution (Langouet and Daire 2009). In the case of Ireland, while local investigation remains vital, study of fish traps on a national scale is now required to reveal the wider trends in their evolution and chronological development.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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